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ABSTRACT

Five activities are presented in this student workbook designed for exploration of a career in computers, and the mathematics related to that career. Included are activities on basic computer language, flow charts, and basic computer programming. Each activity includes the objective, materials needed, and information for completing the activity. Answers to problems presented in the lessons conclude the document. (JH)

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Mathematics Unipac

COMPUTERS

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MATHEMATICS CAREER UNIPAC

COMPUTERS

To the student:

Every person has an objective in life, and whether you want to be a nuclear scientist, operate a small store, operate an industrial machine, construct a home, or operate machines for business and banking, you will need to have a workable knowledge of Mathematics.

This Career-Pac has been developed to help you explore a career in computers, and to help you become more proficient in the use of mathematics related to the career. The lesson in this Career-Pac will give you an opportunity to research, to visit, and to perform the daily tasks involved with computers.

DO NOT WRITE IN THIS BOOKLET!

OBJECTIVE: The student will research and explore the careers in computers. The student will be able to use the mathematics required in the running of a computer.

MATERIALS NEEDED: Occupational Outlook Handbook, calculator, computer teletype, pencil, and paper.

RELATED MATHEMATICS: Computer Programming; Algebra; Flow Charting; Calculator Mathematics.

ACTIVITY: Research

OBJECTIVE: The student will discover the careers available in computers using the library as a resource center.

MATERIALS NEEDED:

a. Occupational Outlook Handbook
b. SRA Occupational Brief
c. Work Brief
d. Occupational Research Service, Volume 2

Computers have become a way of life. It seems as if everything is done by computer. Because of their widespread use, there is a need for manpower to operate, sell, manufacture, program, repair, and demonstrate. Ask your librarian for the Occupational Outlook Handbook. Look up "Office machine and computer manufacturing occupations" and answer the following questions:

1. Computers account for what part of today's industry productions?

2. Computer equipment manufacturers employed how many workers in 1970?

3. There is a wide variety of occupations found in manufacturing office machines. List ten different types of training and skills.

4. What does the largest group of engineers work with in the computer industry?

5. What do Photographic technicians do?

6. What part of the workers are administrators?

7. What part of the workers are clerical?

8. What is a minimum requirement for engineering and scientific jobs?

After having read this material, you may find an occupation that is interesting to you. Ask the librarian for an SRA Occupational Brief, a Work Brief, or Occupational Research Service, Volume 2 to get more specific details on that career.

ACTIVITY: Basic Language

OBJECTIVE: The student will learn the Basic Computer Language (symbols) and translate from numerical symbols to this computer language.

MATERIALS NEEDED: pencil and paper

In order to work with the computer you need to have a working knowledge of the symbols used with the computer. Listed below are the algebraic operations and their corresponding symbols in the Basic Language.

	ALGEBRAIC	BASIC
Add	$3 + 8$	3 + 8
Subtract	$5 - 2$	5 - 2
Multiply	7×4 or $7 \cdot 4$ or $7(4)$	7 * 4
Divide	$4 \div 2$	4 / 2
Powers	3^2	3 ↑ 2

The computer follows the order of operating (Powers first, multiplication and division second, and add and subtract last). If you want to add before you multiply you have to use grouping symbols (parentheses). Here are some examples.

Example 1: $3 \times 4 + 8$

Here you want to multiply then add so you just use the symbols as they are: 3 * 4 + 8

Example 2: $3(4 + 8)$

This time you want to add before you multiply.
Basic: 3 * (4 + 8)

Example 3: $\frac{4 + 3}{7 - 10}$

Here again you want to add and subtract before you divide.
Basic: (4 + 3)/(7 - 10)

Example 4: $7A + 4$
Basic: 7 * A + 4

Example 5: $\frac{M^3 + 3M^2 - 4M}{2A + 1}$
Basic: (M↑ 3 + 3 * M↑ 2 - 4 * M)/(2 * A + 1)

Its your turn. Do the following problems. Put them into the Basic Language. Don't try to find an answer.

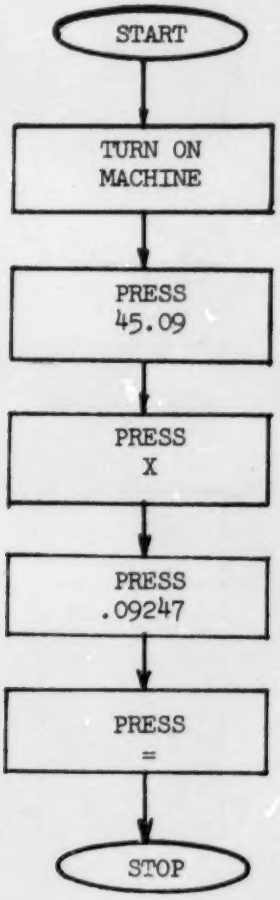
1. 2×3^2
2. $64 \times (.5)^2$
3. $16^2 + 9^2$
4. $100(6)^2 - 75$
5. $(20 - 15)^2$
6. $(7 - 2 \times 3)^3$
7. $200 - 3(5 - 1)^3$
8. $12(5^2 - 4^2)$
9. $\frac{8^2 + 6^2}{2}$
10. $\frac{15^2 + 25^2}{2(4 + 1)}$
11. $2(X + 5)$
12. $4(2X - 3Y)$
13. $\frac{5}{9}(4X - 5)$
14. $3Y - (X - Z)$
15. $3X^2$
16. $(Y + Z)^2$
17. $(W + X)(Y + Z)$
18. $\frac{X + 2A}{4}$
19. $\frac{3A + 2X}{3X - A}$
20. $\frac{X^4 - 2X^2 + 1}{(X - 1)^2(X + 1)^2}$

ACTIVITY: Flow Charts

OBJECTIVE: The student will learn how to read flow charts using a calculator to compute the answers.

MATERIALS NEEDED: Calculator, pencil, and paper.

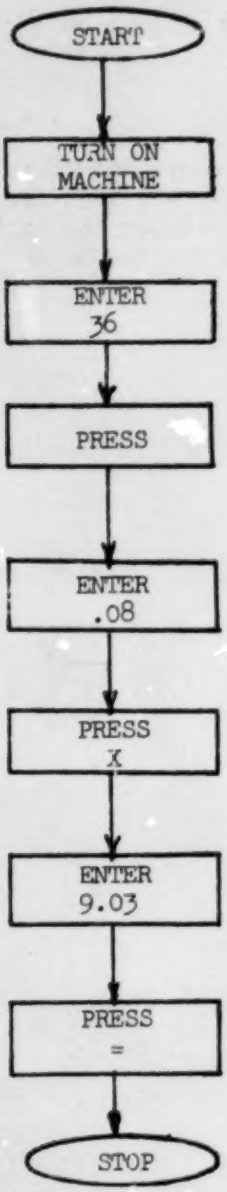
Computer operators use flow charts to map out the various steps needed to solve a problem. A flow chart assumes nothing. In other words, it tells you exactly what to do step by step. Ovals are starts and stops; Rectangles give you instructions; and Diamonds are decisions. Follow the arrows in the flow chart below and see if you can compute the answer.



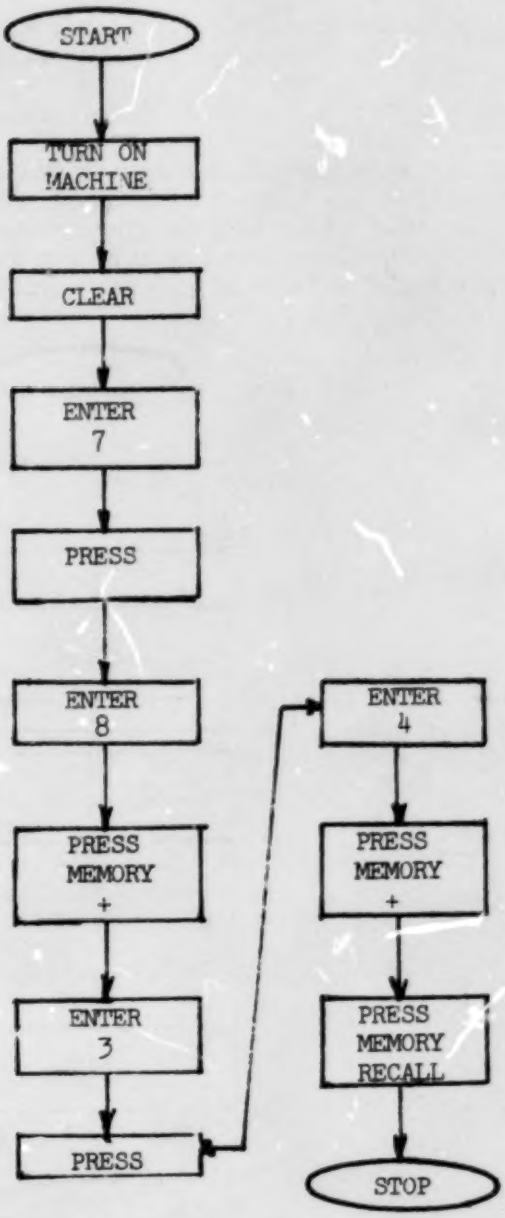
ANSWER: 4.1694723

Determine the answer for each of the following flow charts:

1.



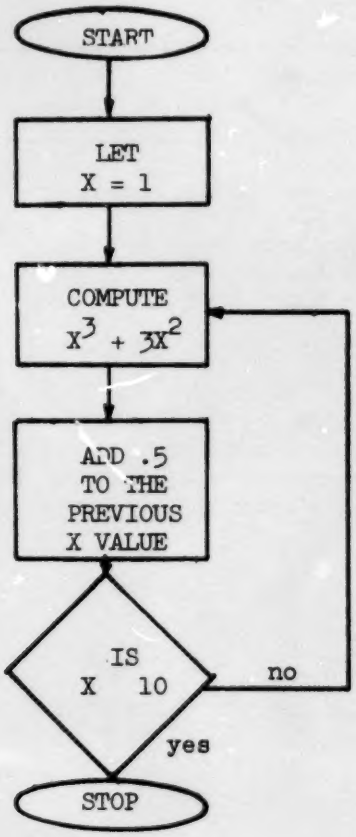
2.



ANSWERS: 1. 4063.5
2. 1.625

There are times when you want to repeat steps. In order to do this, the flow chart will have loops built into it. To get out of a loop the computer has to make a decision. This flow chart is for a computer. You use your calculator to do the computations.

3.

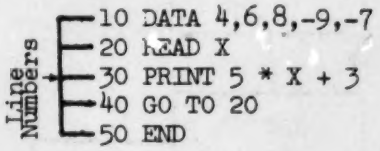


ACTIVITY: Computer Programs

OBJECTIVE: Given a computer program the student will type it into the computer and make a similar program.

MATERIALS NEEDED: Teletype, pencil and paper.

A Computer Program has a set of line numbers that tells the computer the order in which the programmer wants the program done. These numbers are usually a multiple of 10 so that additional line statements can be put into the program as they are needed.



Every program needs two statements a PRINT statement (a PRINT statement tells the computer to type out the answer) and an END statement. There are no lower case letters on a teletype. Everything is done in capital letters. Type the following program on the teletype exactly as you see it. Put in all the punctuation and don't add any extra punctuation.

```
10 PRINT 4 ↑ 3 + 2 * 5 ↑ 2 - (45 * 23)/(2 ↑ 4 - 1)
20 END
```

Now make a program like the one above to find the answer for the following problems:

1) $3^2 + 4^2 - \dfrac{2(3^5 - 7)}{4^2 + 35}$

2) $(7 - 3)(23)(2^6 + 31)(5^6 \div 13)$

Type your program on the teletype and have the computer find the solution. If you have programmed correctly you should get answers of (1) 11.82353, (2 1050480. These answers were done on a calculator. Your answers will be more accurate and they will show more decimal places.

The following programs are more difficult. Type out the program on the teletype and then make programs for the two problems that follow it. Each time you make a program, try it out on the teletype. The first program has a READ and a DATA statement in it. The computer ignores the DATA statement until it sees a READ statement. When the statement says READ Y, it is telling the computer to assign the first value of the DATA for Y. The next time it comes to the READ statement, it assigns the second value of the DATA and this continues until the DATA is all used up. Then the computer stops.

The second program has a FOR - NEXT combination of statements in it. When the computer sees the FOR X = 1 TO 5 STEP .25 it assigns 1 for the value of X. When it gets to NEXT X it goes back to the FOR statement and adds .25 to the 1, so X is now equal to 1.25. The next time around X is equal to 1.5; the third time, 1.75; etc. The 5 tells the computer the upper limit of the X values. In other words it will not add the .25 to 5. It stops after working with 5.

The third program has a decision making step in it. Line 40 tells the computer IF something is true THEN go to the line number shown. IF the first statement is false THEN the computer goes to the next line statement number which in this program is 50.

```
10 DATA 3,-2.5,47,-21,7.25
20 READ Y
30 PRINT 4 * Y   3 - Y / 5
40 GO TO 20
50 END
```

Problems (cont.)

3) Find the Range (set of answers) for the problem $7Y^2 - 3Y + 2$ if the Domain is 4,7,-8,3.1,9.8.
(Domain is DATA values).

4) Find the Range for $9Y^3 - 3Y^2 + 7Y - 5$ with a given Domain of 19,75,-3,14.6,-21.2

```
10 FOR X = 1 TO 5 STEP .25
20 PRINT (5 * X ↑ 2)/(6 * X - 19)
30 NEXT X
40 END
```

5) Find the Range for $\frac{7X}{3X - 2}$ with a Domain of consecutive integers from 1 to 10.

6) Find the Range for $\frac{9X - 4}{3X + 9}$ given a Domain of all the positive even integers less than 21.

```
10 LET M = 1
20 PRINT 7 * M   4 + 3 * M   3 - 18 * M   2 - 196 * M
30 LET M = M + 1
40 IF M   10 THEN 20
50 END
```

7) Given a Domain of positive integers between 10 and 25, write a program that will find the Range for $8M^3 - 2M^2 + 3M - 25$.

8) Given a Domain of negative integers greater than -16, write a program to find the range for $9M^2 - \frac{2}{3}M + 15$.

ACTIVITY: Field Trip

OBJECTIVE: The student will explore the job opportunities available in the computer field by visiting and spending time watching and listening to the computer operators.

MATERIALS NEEDED:

a) Form FT-1973 A-6 Exploration: Field Trip Request
b) Form FT-1973 A-7 Exploration: Student Outline/Evaluation

Go to the Career Office in your school and fill out the FT-1973 A-6: Exploration: Field Trip Request Form. The secretary will make all the necessary arrangements for your visit to a computer center.

Things to Remember During Your Trip

a) Dress neatly
b) Be courteous at all times
c) Try not to get in the workers way
d) Try to find out as much information as possible while you are there

Upon your return go to the Career Office and get a field trip questionaire form (FT-1973 A-7 Exploration: Student Outline/Evaluation). Fill it out completely and return it to the career office.

CAREER-PAC: COMPUTERS

Answers

ACTIVITY: Research

1) More than half
2) 190,000
3) a. engineering, b. scientific, c. technical, d. administrative, e. sales, f. clerical, g. assembly, h. inspection, i. maintenance, j. transportation, k. service.
4) electricity or electronics
5) set up light beams
6) 1/10
7) 1/6
8) Bachelor's Degree in Engineering

ACTIVITY: Basic Language

1) 2 * 3↑ 2
2) 64 * .5 ↑ 2
3) 16↑ 2 + 9 ↑ 2
4) 100 * 6↑ 2 - 75
5) (20 - 15) ↑ 2
6) (7 - 2 * 3) ↑ 3
7) 200 - 3 * (5 - 1) ↑ 3
8) 12 * (5 ↑ 2 - 4↑ 2)
9) (8↑ 2 - 6 ↑ 2)/2
10) (15↑ 2 + 25 ↑ 2)/(2 * (4 + 1))
11) 2 * (X + 5)
12) 4 * (2 * X - 3 * Y)
13) 5/9 * (4 * X - 5)
14) 3 * Y - (X - Z)
15) 3 * X↑ 2
16) (Y + Z) ↑ 2
17) (W + X) * (Y + Z)
18) (X + 2 * A)/4
19) (3 * A + 2 * X)/(3 * X - A)
20) (X↑ 4 - 2 * X↑ 2 + 1)/((X - 1) ↑ 2 * (X + 1)↑ 2)

ACTIVITY: Flow Charts

1) 4063.5

2) 1.625

3)

1	4
1.5	10.125
2	20
2.5	34.375
3	54
3.5	79.625
4	112
4.5	151.875
5	200
5.5	257.125
6	324
6.5	401.375
7	490
7.5	590.625
8	704
8.5	830.875
9	972
9.5	1128.125
10	1300

ACTIVITY: Computer Programs

1)
```
10 PRINT 3↑ 2 + 4↑ 2 - (2 * (3↑ 5 - 7))/(4 ↑ 2 + 35)
20 END
```

2)
```
10 PRINT (7 - 3) * 23 * (2 ↑ 6 + 31) * (5 . 6/13)
20 END
```

3)
```
10 DATA 4,7,-8,3.1,9.8
20 READ Y
30 PRINT 7 * Y↑ 2 - 3 * Y + 2
40 GO TO 20
50 END
```

102
324
798
59.97
644.88

4)
```
10 DATA 19,75,-3,14.6,-21.2
20 READ Y
30 PRINT 9 * Y ↑3 - 3 * Y ↑ 2 + 7 * Y - 5
40 GO TO 20
50 END
```

60776
3,780,520
-296
27,466.944
-87,254.87

5)
```
10 FOR X = 1 TO 25
20 PRINT (7 * X↑7)/(3 * X - 2)
30 NEXT X
40 END
```

1	122,472
224	303,410.57
2187	667,275.63
11468.8	1,339,231.3
42067.307	2,500,000

6)
```
10 FOR X = 2 TO 20 STEP 2
20 PRINT (9 * X↑ 2 - 4)/(3 * X + 9)
30 NEXT X
40 END
```

2.1333333	28.711111
6.6666666	34.509803
11.851851	40.350877
17.333333	46.222222
22.974358	52.115942

7)
```
10 LET M = 11
20 PRINT 8 * M↑ 3 - 2 * M↑ 2 + 3 * M - 25
30 LET M = M + 1
40 IF M < 25 THEN 20
50 END
```

10,414	46,037
13,547	54,132
17,252	63.235
21,577	73,244
26,570	84,257
32,279	96,322
38,752	109.487

8)
```
10 LET M = -15
20 PRINT 9 * M↑ 2 - 2/3 * M + 15
30 LET M = M + 1
40 IF M < 0 THEN 20
50 END
```

2065	460,66666
1788.3333	343
1544.6666	243.33333
1319	161.66666
1111.3333	98
921.66666	52.333333
750	.666666
596.33333	24.666666

14